

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		ATTORNEY'S DOCKET NUMBER 20234/0073
		U.S. APPLICATION NO. (If known, see 37 CFR 1.55) 09/937767
INTERNATIONAL APPLICATION NO. PCT/GB00/01204	INTERNATIONAL FILING DATE 29 March 2000	PRIORITY DATE CLAIMED 29 March 1999
TITLE OF INVENTION WRENCH		
APPLICANT(S) FOR DO/EO/US BUCHANAN, Nigel		
<p>Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:</p> <ol style="list-style-type: none"> <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371 <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. § 371. <input checked="" type="checkbox"/> This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1). <input checked="" type="checkbox"/> A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date. <input checked="" type="checkbox"/> A copy of the International Application as filed (35 U.S.C. 371(c)(2)) <ol style="list-style-type: none"> <input checked="" type="checkbox"/> is transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> has been transmitted by the International Bureau. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). <input type="checkbox"/> A translation of the International Application into English (35 U.S.C. 371(c)(2)). <input checked="" type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> <input type="checkbox"/> are transmitted herewith (required only if not transmitted by the International Bureau). <input type="checkbox"/> have been transmitted by the International Bureau. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. <input checked="" type="checkbox"/> have not been made and will not be made. <input type="checkbox"/> A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). <input type="checkbox"/> A translation of the Annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). <p>Items 11. to 16. below concern other document(s) or information included:</p> <ol style="list-style-type: none"> <input checked="" type="checkbox"/> An Information Disclosure Statement under 37 CFR 1.97 and 1.98. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included. <input checked="" type="checkbox"/> A FIRST preliminary amendment. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. <input type="checkbox"/> A substitute specification. <input type="checkbox"/> A change of power of attorney and/or address letter <input checked="" type="checkbox"/> Other items or information: Copy of the International Search Report; copy of the International Preliminary Examination Report; copy of PCT/IB/306 		

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☒ The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):
 Search Report has been prepared by the EPO or JPO.....\$890.00
 International preliminary examination fee paid to USPTO (37 CFR 1.482)\$710.00
 No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)).....\$740.00
 Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO.....\$1,040.00
 International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4).....\$100.00

CALCULATIONS

PTO USE ONLY

ENTER APPROPRIATE BASIC FEE AMOUNT = \$890.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$130.00

Claims	Number Filed	Number Extra	Rate
Total Claims	22 - 20 =	2	X \$18.00
Independent Claims	1 - 3 =	0	X \$84.00
Multiple dependent claim(s)(if applicable)			+ \$280.00

\$36.00

\$0.00

\$0.00

TOTAL OF ABOVE CALCULATIONS = \$1,056.00

Reduction by 1/2 for filing by small entity, if applicable.

\$0.00

SUBTOTAL = \$1,056.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).

\$0.00

TOTAL NATIONAL FEE = \$1,056.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). \$40.00 per property +

\$0.00

TOTAL FEES ENCLOSED = \$1,056.00

Amount to be:
refunded \$
charged \$

- a. ☒ A check in the amount of \$1,056.00 to cover the above fees is enclosed.
 b. ☐ Please charge my Deposit Account No. 22-0185 in the amount of \$_____ to cover the above fees.
 A duplicate copy of this sheet is enclosed.
 c. ☒ The Director is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 22-0185. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b) must be filed and granted to restore the application to pending status

SEND ALL CORRESPONDENCE TO:

Connolly Bove Lodge & Hutz LLP
 1990 M Street, N.W., Suite 800
 Washington, DC 20036-3425

[Signature]
 for SIGNATURE
 Morris Liss
 NAME

REGISTRATION NUMBER

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of: :
: :
Nigel Buchanan :
: :
Serial No.: To be assigned : Art Unit: To be assigned
: :
Filed: Herewith : Examiner: To be assigned
: :
For: WRENCH : Atty Docket: 20234/0073
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PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to initial examination, please amend the above-captioned case as follows.

IN THE CLAIMS

Please amend claims 1-22 to read as follows:

1. (Amended) A wrench having a head portion adapted to engage and apply torque to a workpiece, said head portion including a flexible ring portion having an inner working surface for engaging the workpiece, such that, when a torque is applied to said head in a predetermined direction, said ring portion closes around said workpiece.
2. (Amended) A wrench as claimed in Claim 1 having a head portion adapted to engage and apply torque to a workpiece, said head portion including a ring member adapted to substantially surround a peripheral surface of a workpiece and having a

first, fixed end and a second, free end such that, when an inner surface of said ring member engages a workpiece and a torque is applied to said head portion in a predetermined direction, said ring member closes around said workpiece.

3. (Amended) A wrench as claimed in Claim 2, wherein said wrench further includes a first cam surface disposed adjacent an outer surface of a free end portion of said ring such that, when said inner surface of said ring member engages said workpiece and said torque is applied to said head portion in said predetermined direction, said first cam surface presses against said outer surface of said free end portion of said ring.

4. (Amended) A wrench as claimed in Claim 3, wherein said first cam surface is generally convex.

5. (Amended) A wrench as claimed in Claim 3, wherein said outer surface of said free end portion is generally concave.

6. (Amended) A wrench as claimed in Claim 3, wherein said first cam surface is formed integrally with said wrench.

7. (Amended) A wrench as claimed in Claim 3, wherein said first cam surface is provided by an insert.

8. (Amended) A wrench as claimed in Claim 2, wherein said ring member comprises a plurality of segments.

9. (Amended) A wrench as claimed in Claim 8, wherein said segments define a generally polygonal inner surface of said ring member.

10. (Amended) A wrench as claimed in Claim 8, wherein each of said segments has an inner surface which is generally convex in the circumferential direction of said ring member.
11. (Amended) A wrench as claimed in Claim 8, wherein at least some of said segments are formed integrally with one another and said ring member is adapted to deform resiliently at junctions between adjacent, integrally formed segments.
12. (Amended) A wrench as claimed in Claim 11, wherein said junctions between adjacent, integrally formed rings have a reduced thickness in the radial direction as compared with the remainder of said segments.
13. (Amended) A wrench as claimed in Claim 12, wherein said junctions comprise portions of the inner surface of said ring member which are generally concave in the circumferential direction of said ring member.
14. (Amended) A wrench as claimed in Claim 2, wherein the inner surface of said ring member is corrugated.
15. (Amended) A wrench as claimed in Claim 2, wherein said head portion includes means for limiting movement of said free end of said ring member relative to said fixed end thereof in said predetermined direction.
16. (Amended) A wrench as claimed in Claim 2, wherein said head portion includes means for limiting movement of said free end of said ring member relative to said fixed end thereof in a direction opposite to said predetermined direction.
17. (Amended) A wrench as claimed in Claim 2, wherein said head portion includes hinge means whereby at least a portion of said ring member may be pivoted in the plane of said ring member relative to the remainder of said head portion.

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18. (Amended) A wrench as claimed in Claim 17, wherein said ring member comprises a plurality of segments and wherein said hinge means is located between at least one pair of adjacent segments.

19. (Amended) A wrench as claimed in Claim 16, including resilient bias means associated with said hinge means and adapted to bias said ring member towards a closed position.

20. (Amended) A wrench as claimed in Claim 1, wherein said ring portion is pivotably connected to a yoke portion of said head and comprises a plurality of segments interconnected by an elongate flexible member having first and second free ends secured to said yoke portion such that pivoting movement of said ring relative to said yoke in a predetermined direction causes a length of said elongate flexible member passing around said ring to be shortened and the ring to close.

21. (Amended) A wrench as claimed in claim 20, wherein first and second segments of said ring are formed integrally with one another as part of a pivot member pivotably mounted in said yoke by means of a pivot pin and the remainder of said segments are formed as discrete members, said flexible elongate member being threaded through said remainder of said segments and the free ends thereof passing around an outer surface of said pivot member and around said pivot pin.

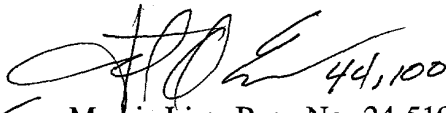
22. (Amended) A wrench as claimed in Claim 21, wherein the first free end of the flexible elongate member extends from one of said discrete segments, passes around one part of said outer surface of said pivot member opposite an inner surface thereof defining a first segment, over the top of, around and under the pivot pin, and out of the front of the yoke portion, and wherein the second free end of the of the elongate flexible member extends from another of said discrete segments, passes around a second part of said outer surface of the pivot member opposite an inner

surface thereof defining a second segment, under the first free end and the pivot pin, and out of the front of the yoke portion.

REMARKS

The claims have been amended to eliminate multiple dependency and to improve their format. None of these amendments is believed to involve any new matter. Accordingly, it is respectfully requested that the foregoing amendments be entered, that the application as so amended receive an examination on the merits, and that the claims as now presented receive an early allowance.

Respectfully submitted,

for  4d,100
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AMENDMENTS TO THE CLAIMS

1. (Amended) A wrench having a head portion [(10,110)] adapted to engage and apply torque to a workpiece [(42)], said head portion [(10,110)] including a flexible ring portion [(14,114)] having an inner working surface for engaging the workpiece [(42)], such that, when a torque is applied to said head [(10,110)] in a predetermined direction [(48,148)], said ring portion closes around said workpiece [(42)].
2. (Amended) A wrench as claimed in Claim 1 having a head portion [(10)] adapted to engage and apply torque to a workpiece [(42)], said head portion [(10)] including a ring member [(14)] adapted to substantially surround a peripheral surface of a workpiece [(42)] and having a first, fixed end [(16)] and a second, free end [(18)] such that, when an inner surface of said ring member [(14)] engages a workpiece [(42)] and a torque is applied to said head portion [(10)] in a predetermined direction [(48)], said ring member [(14)] closes around said workpiece [(42)].
3. (Amended) A wrench as claimed in Claim 2, wherein said wrench further includes a first cam surface [(28)] disposed adjacent an outer surface [(30)] of a free end portion of said ring [(14)] such that, when said inner surface of said ring member [(14)] engages said workpiece [(42)] and said torque is applied to said head portion [(10)] in said predetermined direction [(48)], said first cam surface presses against said outer surface [(30)] of said free end portion of said ring [(14)].
4. (Amended) A wrench as claimed in Claim 3, wherein said first cam surface [(28)] is generally convex.
5. (Amended) A wrench as claimed in Claim 3 [or Claim 4], wherein said outer surface [(30)] of said free end portion is generally concave.

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6. (Amended) A wrench as claimed in [any one of Claims 3 to 5] Claim 3, wherein said first cam surface [(28)] is formed integrally with said wrench.
 7. (Amended) A wrench as claimed in [any one of Claims 3 to 5] Claim 3, wherein said first cam surface [(28)] is provided by an insert [(32)].
 8. (Amended) A wrench as claimed in [any any one of Claims 2 to 7] Claim 2, wherein said ring member [(14)] comprises a plurality of segments [(20a-f)].
 9. (Amended) A wrench as claimed in Claim 8, wherein said segments [(20a-f)] define a generally polygonal inner surface of said ring member [(14)].
 10. (Amended) A wrench as claimed in Claim 8 [or Claim 9], wherein each of said segments [(20a-f)] has an inner surface which is generally convex in the circumferential direction of said ring member [(14)].
 11. (Amended) A wrench as claimed in [any one of Claims 8 to 10] Claim 8, wherein at least some of said segments [(20a-f)] are formed integrally with one another and said ring member [(14)] is adapted to deform resiliently at junctions [(24a-e)] between adjacent, integrally formed segments.
 12. (Amended) A wrench as claimed in Claim 11, wherein said junctions [(24a-e)] between adjacent, integrally formed rings have a reduced thickness in the radial direction as compared with the remainder of said segments [(20af)].
 13. (Amended) A wrench as claimed in Claim 12, wherein said junctions [(24a-e)] comprise portions of the inner surface of said ring member which are generally concave in the circumferential direction of said ring member [(14)].

14. (Amended) A wrench as claimed in [any one of Claims 2 to 13] Claim 2, wherein the inner surface of said ring member is corrugated.

15. (Amended) A wrench as claimed in [any one of Claims 2 to 14] Claim 2, wherein said head portion [(10)] includes means for limiting movement of said free end [(18)] of said ring member [(14)] relative to said fixed end [(16)] thereof in said predetermined direction [(48)].

16. (Amended) A wrench as claimed in [any one of Claims 2 to 15] Claim 2, wherein said head portion [(10)] includes means for limiting movement of said free end [(18)] of said ring member [(14)] relative to said fixed end [(16)] thereof in a direction [(50)] opposite to said predetermined direction [(48)].

17. (Amended) A wrench as claimed in [any one of Claims 2 to 16] Claim 2, wherein said head portion [(10)] includes hinge means [(60,62,64,68,72,74)] whereby at least a portion of said ring member [(14)] may be pivoted in the plane of said ring member [(14)] relative to the remainder of said head portion [(10)].

18. (Amended) A wrench as claimed in Claim 17, wherein said ring member comprises a plurality of segments [(20a-f)] and wherein said hinge means [(60,62,64,68,72,74)] is located between at least one pair of adjacent segments [(20a-f)].

19. (Amended) A wrench as claimed in Claim 16 [or Claim 17], including resilient bias means [(80)] associated with said hinge means [(60,62,64,68,72,74)] and adapted to bias said ring member towards a closed position.

20. (Amended) A wrench as claimed in Claim 1, wherein said ring portion [(114)] is pivotably connected to a yoke portion [(204)] of said head [(110)] and comprises a plurality of segments [(120a-f)] interconnected by an elongate flexible

member [(202)] having first and second free ends [(202a, b)] secured to said yoke portion [(204)] such that pivoting movement of said ring [(114)] relative to said yoke [(204)] in a predetermined direction [(148)] causes a length of said elongate flexible member [(202)] passing around said ring [(114)] to be shortened and the ring [(114)] to close.

21. (Amended) A wrench as claimed in claim 20, wherein first and second segments [(120a, b)] of said ring [(114)] are formed integrally with one another as part of a pivot member [(200)] pivotably mounted in said yoke [(204)] by means of a pivot pin [(206)] and the remainder of said segments [(120c-f)] are formed as discrete members, said flexible elongate member being threaded through said remainder of said segments [(120c-f)] and the free ends [(202a, b)] thereof passing around an outer surface [(214)] of said pivot member and around said pivot pin [(206)].

22. (Amended) A wrench as claimed in Claim 21, wherein the first free end [(202a)] of the flexible elongate member [(202)] extends from one of said discrete segments [(120f)], passes around one part of said outer surface [(214)] of said pivot member [(200)] opposite an inner surface thereof defining a first segment [(120a)], over the top of, around and under the pivot pin [(206)], and out of the front of the yoke portion [(204)], and wherein the second free end [(202b)] of the of the elongate flexible member [(202)] extends from another of said discrete segments [(120c)], passes around a second part of said outer surface [(214)] of the pivot member [(200)] opposite an inner surface thereof defining a second segment [(120b)], under the first free end [(202a)] and the pivot pin [(206)], and out of the front of the yoke portion [(204)].

1 Wrench

2

3 The present invention relates to wrenches (also known
4 as "spanners", particularly in the United Kingdom), and
5 in particular to "ring" wrenches.

6

7 A wrench is a tool for applying torque to a nut, bolt,
8 screw or the like (hereinafter referred to, for
9 convenience, as a "workpiece") for the purpose of
10 tightening or slackening the workpiece. The wrench has
11 a head portion shaped to engage the periphery of the
12 workpiece in a non-rotatable manner such that a force
13 applied to rotate the head transmits torque to the
14 workpiece. The workpiece generally has a polygonal
15 shape, typically hexagonal or square, and the head of
16 the wrench has a complementary shape and size. The head
17 of a ring wrench is configured to substantially
18 surround the periphery of the workpiece.

19

20 The following description will refer particularly to
21 wrenches for use with hexagonal nuts. However, it will
22 be understood that the invention is equally applicable

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1 to wrenches and corresponding nuts having other shapes
2 and to other types of workpiece such as bolts and
3 screws.

4
5 A conventional ring wrench has a ring-shaped head with
6 a hexagonally shaped inside surface, each section of
7 which is substantially flat. In use, the flat surfaces
8 and corners on the inner surface of the head engage the
9 flat surfaces and corners of the nut to be tightened or
10 slackened. When the head is rotated in the appropriate
11 direction the nut is slackened or tightened as
12 required. However if the nut is undersized, damaged or
13 worn, it is very likely that the head will 'slip' and
14 rotate around the nut instead of properly gripping or
15 engaging the flats and corners of the nut.

16
17 It is an object of the present invention to provide an
18 improved wrench with which workpieces that are
19 undersized, damaged or worn can be reliably engaged by
20 the wrench for applying a torque thereto.

21
22 In accordance with the invention there is provided a
23 wrench having a head portion adapted to engage and
24 apply torque to a workpiece, said head portion
25 including a flexible ring portion having an inner
26 working surface for engaging the workpiece, such that,
27 when a torque is applied to said head in a
28 predetermined direction, said ring portion closes
29 around said workpiece.

30
31

1 Preferably, said head portion is adapted to engage and
2 apply torque to a workpiece, said head portion
3 including a ring member adapted to substantially
4 surround a peripheral surface of a workpiece and having
5 a first, fixed end and a second, free end such that,
6 when an inner surface of said ring member engages a
7 workpiece and a torque is applied to said head portion
8 in a predetermined direction, said ring member closes
9 around said workpiece.

10

11 Preferably, said wrench further includes a first cam
12 surface disposed adjacent an outer surface of a free
13 end portion of said ring such that, when said inner
14 surface of said ring member engages said workpiece and
15 said torque is applied to said head portion in said
16 predetermined direction, said first cam surface presses
17 against said outer surface of said free end portion of
18 said ring.

19

20 Preferably also, said first cam surface is generally
21 convex.

22

23 Preferably also, said outer surface of said free end
24 portion is generally concave.

25

26 Optionally, said first cam surface is formed integrally
27 with said wrench or said first cam surface is provided
28 by an insert.

29

30 Preferably, said ring member comprises a plurality of
31 segments.

32

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1 Preferably also, said segments define a generally
2 polygonal inner surface of said ring member.

3

4 Preferably also, each of said segments has an inner
5 surface which is generally convex in the
6 circumferential direction of said ring member.

7

8 Preferably, at least some of said segments are formed
9 integrally with one another and said ring member is
10 adapted to deform resiliently at junctions between
11 adjacent, integrally formed segments.

12

13 Preferably also, said junctions between adjacent,
14 integrally formed rings have a reduced thickness in the
15 radial direction as compared with the remainder of said
16 segments.

17

18 Preferably also, said junctions comprise portions of
19 the inner surface of said ring member which are
20 generally concave in the circumferential direction of
21 said ring member.

22

23 Optionally, the inner surface of said ring member is
24 corrugated.

25

26 Preferably, said head portion includes means for
27 limiting movement of said free end of said ring member
28 relative to said fixed end thereof in said
29 predetermined direction.

30

31 Preferably, said head portion includes means for
32 limiting movement of said free end of said ring member

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1 relative to said fixed end thereof in a direction
2 opposite to said predetermined direction.

3

4 Preferably, said head portion includes hinge means
5 whereby at least a portion of said ring member may be
6 pivoted in the plane of said ring member relative to
7 the remainder of said head portion.

8

9 Preferably also, said ring member comprises a plurality
10 of segments and said hinge means is located between at
11 least one pair of adjacent segments.

12

13 Preferably also, the wrench includes resilient bias
14 means associated with said hinge means and adapted to
15 bias said ring member towards a closed position.

16

17 In an alternative embodiment, ring portion is pivotably
18 connected to a yoke portion of said head and comprises
19 a plurality of segments interconnected by an elongate
20 flexible member having first and second free ends
21 secured to said yoke portion such that pivoting
22 movement of said ring relative to said yoke in a
23 predetermined direction causes a length of said
24 elongate flexible member passing around said ring to be
25 shortened and the ring to close.

26

27 Preferably, first and second segments of said ring are
28 formed integrally with one another as part of a pivot
29 member pivotably mounted in said yoke by means of a
30 pivot pin and the remainder of said segments are formed
31 as discrete members, said flexible elongate member
32 being threaded through said remainder of said segments

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1 and the free ends thereof passing around an outer
2 surface of said pivot member and around said pivot pin.

3
4 Preferably also, the first free end of the flexible
5 elongate member extends from one of said discrete
6 segments, passes around one part of said outer surface
7 of said pivot member opposite an inner surface thereof
8 defining a first segment, over the top of, around and
9 under the pivot pin, and out of the front of the yoke
10 portion, and wherein the second free end of the of the
11 elongate flexible member extends from another of said
12 discrete segments, passes around a second part of said
13 outer surface of the pivot member opposite an inner
14 surface thereof defining a second segment, under the
15 first free end and the pivot pin, and out of the front
16 of the yoke portion.

17
18 Embodiments of the invention will now be described, by
19 way of example only, with reference to the accompanying
20 drawings in which:

21
22 Fig. 1 is a front elevation of a head portion of a
23 first embodiment of a wrench in accordance with the
24 present invention;

25
26 Figs. 2a, 2b and 2c are front elevations of examples of
27 dual-head wrenches of different sizes in accordance
28 with the embodiment of Fig. 1;

29
30 Fig. 3a illustrates in perspective the wrench of Fig. 1
31 gripping a worn nut and Fig.3b shows a perspective view
32 of the worn nut of Fig. 3a;

1

2 Fig. 4a is a front elevation of a head portion of a
3 second embodiment of a wrench in accordance with the
4 present invention, and Fig.4b is an end elevation the
5 wrench of Fig.4a;

6

7 Fig. 5 is a front elevation of a head portion of a
8 third embodiment of a wrench in accordance with the
9 present invention;

10

11 Figs. 6a-6d are front elevations of a head portion of a
12 fourth embodiment of a wrench in accordance with the
13 present invention in which head is hinged, Fig. 6a
14 showing the head in its working position and Figs. 6b,
15 6c and 6d showing the head rotated by different angles
16 about the hinge;

17

18 Fig. 7 is a front elevation of the head portion of a
19 fifth embodiment of a wrench in accordance with the
20 present invention in which the head is hinged;

21

22 Fig. 8 is a front elevation of the head portion of a
23 sixth embodiment of a wrench in accordance with the
24 present invention in which the head is hinged, and in
25 which the hinge is provided by a ball and socket joint;

26

27 Fig. 9 is a front elevation of the head portion of a
28 seventh embodiment of a wrench in accordance with
29 the present invention in which the head is hinged, and
30 in which the hinge is provided by a knuckle joint;

31

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1 Figs. 10a-10c are front elevations of the head portion
2 of an eighth embodiment of a wrench in accordance with
3 the present invention, in which the head is hinged, Fig
4 10c showing the head in its working position and Figs.
5 10a and 10b showing the head in fully and partially
6 open positions;

7
8 Figs. 11a and 11b are front elevations of the head
9 portion of a ninth embodiment of a wrench in accordance
10 with the present invention in which the head includes
11 multiple hinges, Fig.11a showing the head in its
12 working position and Fig. 11b showing the head in an
13 open position, and Fig.11c is a side elevation the
14 wrench of Fig.11a;

15
16 Figs. 12a-12e are front elevations of the head portion
17 of tenth embodiment of a wrench in accordance with the
18 present invention, in which the head is hinged by means
19 of a chain link interconnecting two portions of the
20 head, Fig. 12a showing the head in its working position
21 and Figs. 12b-12e showing the head rotated by different
22 angles about the hinge, and Figs. 12f-12h are
23 perspective views illustrating the chain link of Figs.
24 12a-12e;

25
26 Figs. 13a and 13b are front elevations of the head
27 portion of an eleventh embodiment of a wrench in
28 accordance with the invention, in which the head is
29 hinged by means of a chain link and incorporating
30 resilient bias means, and Fig. 13c is a front elevation
31 of a chain link incorporating integral resilient bias
32 elements;

1

2 Fig. 14 is a front elevation of the head portion of a
3 twelfth embodiment of a wrench in accordance with the
4 present invention; and

5

6 Fig. 15a is a side elevation, partly in section, of a
7 thirteenth embodiment of the present invention and Fig.
8 15b is an exploded perspective view of components of
9 the wrench of Fig. 15a.

10

11 The embodiments of the invention will now be described
12 with reference to the drawings. In the various
13 embodiments and corresponding drawings, like reference
14 numerals will be used to indicate like features.

15

16 Referring now to Fig. 1 of the drawings, a wrench in
17 accordance with the invention includes a head portion
18 10 connected to a shaft or handle 12. The head portion
19 10 is in the form of a ring 14 intended to
20 substantially surround the peripheral surface of a
21 workpiece such as a nut, bolt or screw. In use, the
22 inner surface of the head 10 engages the peripheral
23 surface of the workpiece. Fig. 1 shows the wrench in
24 its "rest" condition, with no torque applied.

25

26 The ring 14 has a first, fixed end 16 connected to the
27 shaft 12 and a second, free end 18 which terminates
28 close to the first end 16 but which is not connected
29 thereto or to the shaft 12. In this embodiment, the
30 ring 14 is divided into segments 20a-f corresponding in
31 number to the number of faces of the peripheral surface
32 of the workpiece with which the wrench is intended to

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1 be used, such that the inner surface of the ring 14 has
2 a generally polygonal configuration. Preferably, the
3 inner surface 22 of each segment 20a-f is generally
4 convex, such that the thickness of the ring 14 varies
5 around its circumference, being thinnest at the
6 junctions 24a-e between adjacent segments. Preferably
7 also, the junctions 24a-e are radiused (concave). The
8 free end 18 comprises part of the end segment 20f of
9 the ring 14.

10

11 The head 10 further includes a cam portion 26 located
12 radially outwards from the end segment 20f of the ring
13 14 and defining a first cam surface 28 adapted to co-
14 operate with a second cam surface 30 provided by the
15 outer surface of the end segment 20f of the ring 14.
16 The first cam surface 28 is preferably generally convex
17 and the second cam surface 30 is preferably generally
18 concave (such that the outer surface of the end segment
19 20f of the ring is configured as a decreasing ramp).
20 The first cam surface 28 may be provided by an insert
21 in the cam portion 26 such as a cylindrical pin or
22 roller 32. Adjacent the cam portion 26 there is
23 provided an abutment surface 34, generally parallel to
24 an end surface 36 of the free end 18 of the ring 14 and
25 spaced therefrom by a gap 38.

26

27 Figs. 2a to 2c show a set of dual-head wrenches 40
28 incorporating the head design illustrated in Fig. 1.
29 As in the case of conventional wrenches, wrenches in
30 accordance with the present invention may be provided
31 in a variety of sizes to suit standard workpiece sizes,
32 with single or dual heads. A dual-head wrench could

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1 incorporate a first head in accordance with the
2 invention and a second conventional head.

3

4 Fig. 3b illustrates a nut 42 engaging a bolt 44, and
5 Fig. 3a shows the wrench of Fig. 1 engaging the nut 42.

6 It is common for the nuts, bolt heads etc to become
7 worn in use, so that the corners 46 of the nut between
8 its peripheral faces wear flat as shown in Fig. 3b.

9 The head of a conventional wrench will tend to slip
10 around a worn nut of this type.

11

12 When a wrench in accordance with the present invention
13 is engaged with a nut 6 as shown in Fig. 3a and a force
14 applied to the head in the direction of the arrow 48
15 (i.e. in the direction defined by the shortest distance
16 between the fixed end 16 and the free end 18 of the
17 ring) then, assuming that a certain minimal degree of
18 friction is generated between the inner surface of the
19 ring and the nut 42, the ring 14 will deform and tend
20 to close around the nut 42, progressively tightening
21 the grip between the ring 14 and the nut 42 and
22 preventing any slippage even if the nut 42 is
23 significantly worn, damaged or undersized.

24

25 In more detail, when torque is applied to the wrench in
26 the direction shown by the arrow 48, this causes the
27 first cam surface 28 to press against the second cam
28 surface 30, pushing the free end 18 of the ring 14
29 inwards towards the nut 42. The torque applied when
30 the shaft is first turned causes a force to be applied
31 radially inwards from the free end 18 onto the nut 42.
32 This force effectively wedges the free end 18 against

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1 the nut 42. When further torque applied, the wrench
2 shaft and ring are pulled around in the direction 48
3 such that the cam moves along the second cam surface 30
4 in the direction shown by arrow 48. The shape of the
5 second cam surface 30 also means that the abutting
6 surface 36 of the end segment 20f of the ring 14 moves
7 towards the abutment 34, narrowing the gap 38.

8
9 In effect, the ring is being stretched from the
10 position of the last segment 20f which is secured
11 against the nut. The force transmitted around the ring
12 14 also acts to deform the ring at the segment
13 junctions 24a-e. The convex shape of inner surfaces 22
14 of the ring segments 20a-f also serve to enhance the
15 grip between the ring 14 and the peripheral surfaces of
16 the workpiece. Even if the workpiece is damaged, worn
17 or undersized, providing there is sufficient initial
18 contact and friction between the ring and the
19 workpiece, the ring 14 will deform inwards to provide
20 increased grip enabling further torque to be applied to
21 rotate the workpiece.

22
23 In the embodiments of Figs. 1 to 3, the junctions 24a-e
24 between adjacent segments 20a-f of the ring 14 provide
25 "integral hinges", allowing the ring to deform
26 elastically and close around the workpiece. The
27 surfaces 34 and 36 limit the deformation of the ring 14
28 when torque is applied in the direction of the arrow
29 48. However, if torque was applied in the opposite
30 direction (arrow 50 in Fig. 1), there is a risk that
31 the ring 14 would be damaged by being deformed
32 plastically.

1
2 Figs. 4a and 4b illustrate a further embodiment of the
3 invention which is similar to that of Fig. 1 except
4 that the head 10 includes means for preventing the ring
5 14 from opening excessively if the head 10 is rotated
6 in the direction indicated by the arrow 50. The free
7 end 18 of the ring 14 is provided with an outward
8 projection 52 which co-operates with a corresponding
9 recess 54 formed in the cam portion 26. In this
10 example, the insert 32 of Fig. 1 is omitted and the
11 first cam surface 28 is formed integrally with the cam
12 portion 26.

13
14 Fig. 5. illustrates a further embodiment similar to Fig.
15 1 and Fig. 2, with a different configuration of a catch
16 arrangement to prevent opening of the ring. In this
17 example, the free end 56 of the end segment 20f of the
18 ring 14 is extended and is accommodated by a notch or
19 channel 58 formed in the head portion 10 adjacent the
20 cam portion 26. The extended free end 56 and notch 58
21 co-operate to limit movement of the end segment 20f of
22 the ring 14 both in the direction of the arrow 48 and
23 in the direction of the arrow 50. Other equivalent
24 arrangements may be employed in these or any of the
25 other embodiments of the invention to limit movement of
26 the end segment 20f in either or both of the directions
27 48 and 50.

28
29 The embodiment of Fig. 5 again includes an insert 32
30 which provides the first cam surface 28 of the wrench.
31 It will be understood that an insert of this type may
32 be included in any of the embodiments of the invention,

1 or the first cam surface 28 may be formed as an
2 integral part of the head of the wrench in any of the
3 embodiments of the invention.

4
5 In the embodiments described thus far, the head of the
6 wrench comprises a substantially closed ring which, in
7 use, substantially surrounds the workpiece. As with
8 conventional ring-type wrenches, this arrangement means
9 that, in certain circumstances, it may be difficult or
10 impossible for the wrench to engage a particular
11 workpiece.

12
13 Figs 6a-6d illustrate a further embodiment of the
14 present invention in which the ring defined by the head
15 of the wrench is provided with a hinge or pivot 60,
16 enabling the ring 14 to be opened in order to engage a
17 workpiece. In this example, the hinge 60 is provided
18 at the junction 24a between first and second segments
19 adjacent the fixed end 16 of the ring 14. Fig. 6a
20 shows the ring closed, in position for use. Figs. 6b,
21 6c and 6d illustrate the use of the hinge 60 to open
22 the ring 14. This embodiment is particularly useful
23 where the ring 14 of the wrench is to be fitted around,
24 for example, a nut located on a length of pipe. The
25 hinge 60 allows the ring 14 to be opened out to allow
26 it to be easily fitted around the workpiece. This has
27 particular advantages over traditional closed ring
28 wrenches which cannot be used if the ring cannot be
29 fitted over the end of the pipe to be positioned on the
30 nut. Once in position, the wrench of the present
31 invention can be used to tighten or loosen the nut or
32 bolt as previously described.

1
2 Fig.7 shows a wrench in accordance with the present
3 invention similar to that of Figs 6 a-d, but with an
4 integral first cam surface 28 rather than an insert. In
5 this example also, the convex inner surfaces 22 of the
6 ring segments 20a-f have less curvature than in the
7 embodiment of Fig.1. This provides a larger surface
8 area of contact between these surfaces and the surfaces
9 of the workpiece. In addition, the junctions 24a-e are
10 radiused so as to be substantially semicircular in
11 profile.

12
13 Fig.8 shows further embodiment of a wrench in
14 accordance with present invention, similar to that of
15 Figs 6 a-d, but with a hinge provided by ball and
16 socket joint 62 which, in this example, is located
17 between the second and third ring segments 20b,20c.

18 Fig. 9 shows a wrench in accordance with the present
19 invention similar to that of Figs 6 a-d, with a knuckle
20 joint 64 providing a hinge between the first and second
21 ring segments 20a,20b. This embodiment is shown in its
22 working position, where a torque is to be applied in
23 the direction shown by arrow 48, such that the free end
24 18 of the ring 14 moves freely towards the abutment 34.
25 The extent of this free movement is determined by a gap
26 66 formed by the knuckle joint between the adjacent
27 ring segments 20a,20b. Once this gap 66 has been
28 closed, any additional torque will cause the ring 14 to
29 deform and the area inside the ring to decrease. The
30 abutment of the segments 20a,20b provides additional
31 leverage.

32

1 Figs. 10a, 10b and 10c show a wrench in accordance with
2 the present invention similar to that of Figs 6 a-d,
3 with an extended ball and socket joint 68 providing a
4 hinge between the second and third ring segments
5 20b,20c. This figure also shows the extent to which the
6 ring 14 may be opened to allow an object to be fitted
7 inside the ring. As with Fig. 9, the ring 14 moves
8 freely until an extension portion 71 of the ball and
9 socket joint 68, connected to the third ring segment
10 20c, abuts against the outer surface of the second ring
11 segment 20b. Thereafter, the area inside the ring is
12 decreased by deformation of the ring about the
13 junctions 24c-e between the segments 20c-f.

14
15 Figs. 11a, 11b and 11c illustrate a further embodiment
16 of the present invention in which pivot hinges 72 are
17 provided between each of the segments 20a-f of the ring
18 14.

19
20 In use, the wrench illustrated in Figs. 11a, 11b and
21 11c allows the ring 14 to be opened out as shown in
22 Fig. 11b because each of the segments is rotatable
23 about the hinges 72. This again allows the wrench to
24 be positioned around a nut or bolt located on a length
25 of pipe.

26
27 Whilst the above examples describe a ring inner surface
28 which is substantially hexagonal in shape, in its
29 working position, further examples of the present
30 invention are envisaged in which the inner surface is
31 triangular, square, pentagonal, heptagonal, octagonal,

1 nonagonal, decagonal or having a larger number of
2 sides.

3

4 Figs 12a-e illustrate a further embodiment of the
5 present invention in which the third and fourth ring
6 segments 20c,20d are hingeably connected by a chain
7 link 74. The term "chain link" as used herein means an
8 arrangement in which a plate member 76 having a figure-
9 of-eight configuration is disposed on either side of
10 the ring 14 and pivot pins 78 extend between the plates
11 76 through bores formed at the ends of the adjacent
12 ring segments 20c,20d. This is a preferred form of
13 hinge for use in accordance with the present invention
14 and may be employed to interconnect one or more pairs
15 of ring segments other than or in addition to the third
16 and fourth segments as shown in this embodiment. Fig.
17 12a shows the wrench in its working position (closed)
18 and Figs. 12b-e show the ring 14 progressively opening
19 from the working position. Figs. 12f to 12h illustrate
20 the chain link 74 in more detail. Fig. 12f is an
21 exploded view of the chain link 74, also including a
22 spring clip 79 which would normally be included in a
23 chain link of this type. Fig. 12g shows the ring 14
24 hinged open and Fig. 12h shows the ring 14 hinged
25 closed.

26

27 Figs. 13a and 13b show a further embodiment of the
28 invention, similar to that of Figs. 12a-e, in which the
29 chain link hinge 74 is provided with resilient bias
30 means comprising spring elements 80 which tend to urge
31 the ring 14 towards its normal closed, working
32 position, illustrated in Fig. 13a. The combination of

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1 the hinge and resilient bias means generally provides a
2 junction between the adjacent ring sections connected
3 by the hinge 74 (segments 20c,20d in this preferred
4 example) which is more flexible than the "integral
5 hinges" provided by the junctions 24a,b,d,e between the
6 other pairs of adjacent segments. The use of such
7 resilient bias means that the wrench operates in a
8 substantially identical manner to that of the
9 embodiment of Fig. 1 when rotated in the direction 48.
10 However, when rotated in the opposite direction 50, the
11 resilient bias means associated with the hinge 74
12 allows the ring 14 to open slightly so that the ring 14
13 may rotate relative to the workpiece, thereby providing
14 a type of ratchet mechanism so that the wrench does not
15 need to be removed from the workpiece between
16 successive strokes in the "working direction" 48. The
17 bias means allows the ring to rotate relative to the
18 workpiece on the return stroke, and urges the ring
19 segments back into their working position for the next
20 working stroke.

21
22 In this example, the spring elements 80 are formed
23 integrally with the plates 76 of the chain link 74,
24 comprising resilient arms 82 which extend from either
25 end of the plates 76, curving in the plane of the
26 plates 76 around the outer ends thereof, and having end
27 portions 84 which are bent out of the plane of the
28 plates 76. When the plates 76 are located on either
29 side of the ring segments 20c,20d, the end portions 84
30 of the arms 82 project into and engage with apertures
31 86 formed in the side faces of the adjacent ring
32 segments 20c,20d.

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1

2 The ring 14 may be opened against the return force of
3 the spring elements 80 as seen in Fig. 13b, allowing
4 the wrench to engage, for example, a nut located on a
5 length of pipe, as in the previous embodiments of the
6 invention incorporating hinged rings.

7

8 It will be understood that different types of resilient
9 bias means may be incorporated into chain link hinges
10 of the type employed in the embodiments of Figs. 12 and
11 13, or into other types of hinges.

12

13 Fig 14 shows a further embodiment of the present
14 invention in which the inside surface of the ring 14 is
15 substantially circular, rather than polygonal. The
16 inner surface of the ring 14 is provided with
17 corrugations or serrations 90 which grip the workpiece
18 inside the ring on application of a torque. The ring
19 14 as a whole is sufficiently flexible to deform and
20 close around the workpiece. The size, shape and
21 distribution of the corrugations 90 will depend on the
22 nature of the intended workpiece. This embodiment may
23 also be modified to incorporate variations of the cam
24 surfaces, stops and catches, hinges etc. described in
25 relation to previous embodiments. Also, the segmented
26 rings of previous embodiments may be provided with
27 serrations or corrugations on their inner surfaces.

28

29 Figs. 15a and 15b show a further alternative embodiment
30 of a wrench in accordance with the present invention,
31 again comprising a assembly 110 and a shaft 112.

32

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1 In this embodiment, the head 110 comprises a ring
2 assembly 114 which consists of a generally V-shaped
3 member 200, the inner surfaces which define first and
4 second segments 120a and 120b of the ring, and a
5 plurality of discrete segments 120c-f. The V-shaped
6 member 200 and the segments 120c-f are interconnected
7 by an elongate, substantially inelastic, flexible
8 member 202, such as a strap or the like (suitably
9 formed from metal, plastics, leather or textile
10 material) which is threaded through the segments 120c-
11 f. The head 110 further includes a yoke portion 204
12 formed at the upper end of the shaft 112. The V-shaped
13 member is pivotably mounted in the yoke portion 204 by
14 means of a pivot pin 206 which extends through yoke
15 apertures 208 and complementary apertures 210 formed
16 adjacent the apex of the V-shaped member 200.

17
18 The outer surface of the V-shaped member 200 is formed
19 with a channel 212, defining a saddle surface 214
20 extending between two lug portions 216 which contain
21 the apertures 210. The strap 202 has first and second
22 free ends 202a and 202b. The first free end 202a of
23 the strap 202 extends from the segment 120f, passes
24 around one half of the saddle surface 214 opposite the
25 segment surface 120a, over the top of, around and under
26 the pivot pin 206, and out of the front of the yoke
27 portion 204. The second free end 202b of the of the
28 strap 202 extends from the segment 120c, passes around
29 the second half of the saddle surface 214 opposite the
30 segment surface 120b, under the first free end 202a and
31 the pivot pin 206, and out of the front of the yoke
32 portion 204. Both of the free ends 202a and 202b are

1 secured to the front of the yoke portion 204 by any
2 suitable means such as rivets 218 engaging apertures
3 220.

4
5 In use, the ring assembly 114 is placed over the
6 workpiece. When torque is applied to the yoke 204 in
7 the direction of the arrow 148, the yoke 204 pivots
8 relative to the V-shaped member 200, pulling on the
9 second free end 202b of the strap 202 so that the trap
10 202 is pulled through the segments 120c-f, closing the
11 ring 114 about the workpiece by decreasing the
12 circumference of the head ring 114 and tightening the
13 grip of the ring 114 around the workpiece. Further
14 torque applied to the shaft allows the workpiece to be
15 rotated with the head of the wrench.

16
17 It will be appreciated that the extent of tightening of
18 the strap per unit angle through which the shaft has
19 been turned in the direction of arrow 148 is dependent
20 upon the circumference of the pivot pin 206. A larger
21 pin circumference will tighten the strap by turning the
22 shaft through a smaller angle than would be required
23 where the pin circumference is smaller.

24
25 If torque is applied opposite to the direction of the
26 arrow 148, the angle between the head and the shaft is
27 changed such that the strap is loosened to allow the
28 head 122 to be fitted over larger workpieces. The
29 wrench 100 is operated as before, by turning the shaft
30 in the direction of arrow 124. This embodiment
31 therefore provides additional flexibility by allowing
32 the wrench to be used on differently sized work pieces

1 depending on the initial angle between the shaft and
2 the head. The arrangement may also allow the ring 114
3 to ratchet about the workpiece on return strokes
4 between working strokes, as previously described in
5 relation to other embodiments of the invention.
6
7 Improvements and modifications may be incorporated
8 without departing from the scope of the invention as
9 defined in the Claims appended hereto.

1 CLAIMS

2

3 1. A wrench having a head portion (10,110) adapted to
4 engage and apply torque to a workpiece (42), said head
5 portion (10,110) including a flexible ring portion
6 (14,114) having an inner working surface for engaging
7 the workpiece (42), such that, when a torque is applied
8 to said head (10,110) in a predetermined direction
9 (48,148), said ring portion closes around said
10 workpiece (42).

11

12 2. A wrench as claimed in Claim 1 having a head
13 portion (10) adapted to engage and apply torque to a
14 workpiece (42), said head portion (10) including a ring
15 member (14) adapted to substantially surround a
16 peripheral surface of a workpiece (42) and having a
17 first, fixed end (16) and a second, free end (18) such
18 that, when an inner surface of said ring member (14)
19 engages a workpiece (42) and a torque is applied to
20 said head portion (10) in a predetermined direction
21 (48), said ring member (14) closes around said
22 workpiece (42).

23

24 3. A wrench as claimed in Claim 2, wherein said
25 wrench further includes a first cam surface (28)
26 disposed adjacent an outer surface (30) of a free end
27 portion of said ring (14) such that, when said inner
28 surface of said ring member (14) engages said workpiece
29 (42) and said torque is applied to said head portion
30 (10) in said predetermined direction (48), said first
31 cam surface presses against said outer surface (30) of
32 said free end portion of said ring (14).

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1

2 4. A wrench as claimed in Claim 3, wherein said first
3 cam surface (28) is generally convex.

4

5 5. A wrench as claimed in Claim 3 or Claim 4, wherein
6 said outer surface (30) of said free end portion is
7 generally concave.

8

9 6. A wrench as claimed in any one of Claims 3 to 5,
10 wherein said first cam surface (28) is formed
11 integrally with said wrench.

12

13 7. A wrench as claimed in any one of Claims 3 to 5,
14 wherein said first cam surface (28) is provided by an
15 insert (32).

16

17 8. A wrench as claimed in any any one of Claims 2 to
18 7, wherein said ring member (14) comprises a plurality
19 of segments (20a-f).

20

21 9. A wrench as claimed in Claim 8, wherein said
22 segments (20a-f) define a generally polygonal inner
23 surface of said ring member (14).

24

25 10. A wrench as claimed in Claim 8 or Claim 9, wherein
26 each of said segments (20a-f) has an inner surface
27 which is generally convex in the circumferential
28 direction of said ring member (14).

29

30 11. A wrench as claimed in any one of Claims 8 to 10,
31 wherein at least some of said segments (20a-f) are
32 formed integrally with one another and said ring member

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1 (14) is adapted to deform resiliently at junctions
2 (24a-e) between adjacent, integrally formed segments.

3

4 12. A wrench as claimed in Claim 11, wherein said
5 junctions (24a-e) between adjacent, integrally formed
6 rings have a reduced thickness in the radial direction
7 as compared with the remainder of said segments (20a-
8 f).

9

10 13. A wrench as claimed in Claim 12, wherein said
11 junctions (24a-e) comprise portions of the inner
12 surface of said ring member which are generally concave
13 in the circumferential direction of said ring member
14 (14).

15

16 14. A wrench as claimed in any one of Claims 2 to 13,
17 wherein the inner surface of said ring member is
18 corrugated.

19

20 15. A wrench as claimed in any one of Claims 2 to 14,
21 wherein said head portion (10) includes means for
22 limiting movement of said free end (18) of said ring
23 member (14) relative to said fixed end (16) thereof in
24 said predetermined direction (48).

25

26 16. A wrench as claimed in any one of Claims 2 to 15,
27 wherein said head portion (10) includes means for
28 limiting movement of said free end (18) of said ring
29 member (14) relative to said fixed end (16) thereof in
30 a direction (50) opposite to said predetermined
31 direction (48).

32

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1 17. A wrench as claimed in any one of Claims 2 to 16,
2 wherein said head portion (10) includes hinge means
3 (60, 62, 64, 68, 72, 74) whereby at least a portion of
4 said ring member (14) may be pivoted in the plane of
5 said ring member (14) relative to the remainder of said
6 head portion (10).

7
8 18. A wrench as claimed in Claim 17, wherein said ring
9 member comprises a plurality of segments (20a-f) and
10 wherein said hinge means (60, 62, 64, 68, 72, 74) is
11 located between at least one pair of adjacent segments
12 (20a-f).

13
14 19. A wrench as claimed in Claim 16 or Claim 17,
15 including resilient bias means (80) associated with
16 said hinge means (60, 62, 64, 68, 72, 74) and adapted
17 to bias said ring member towards a closed position.

18
19 20. A wrench as claimed in Claim 1, wherein said ring
20 portion (114) is pivotably connected to a yoke portion
21 (204) of said head (110) and comprises a plurality of
22 segments (120a-f) interconnected by an elongate
23 flexible member (202) having first and second free ends
24 (202a,b) secured to said yoke portion (204) such that
25 pivoting movement of said ring (114) relative to said
26 yoke (204) in a predetermined direction (148) causes a
27 length of said elongate flexible member (202) passing
28 around said ring (114) to be shortened and the ring
29 (114) to close.

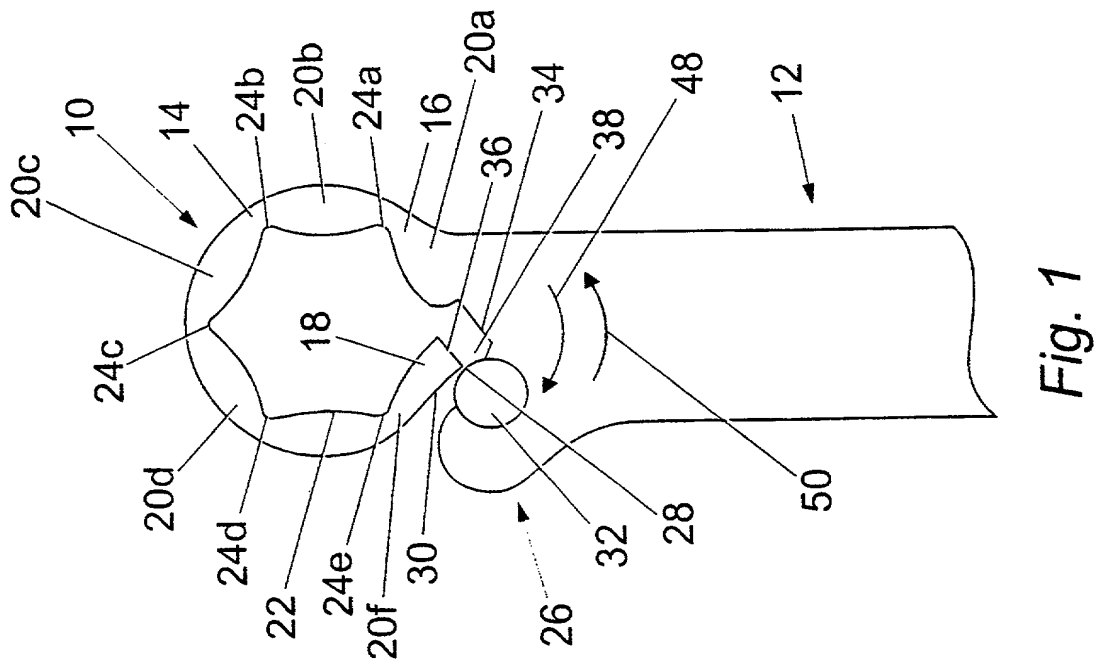
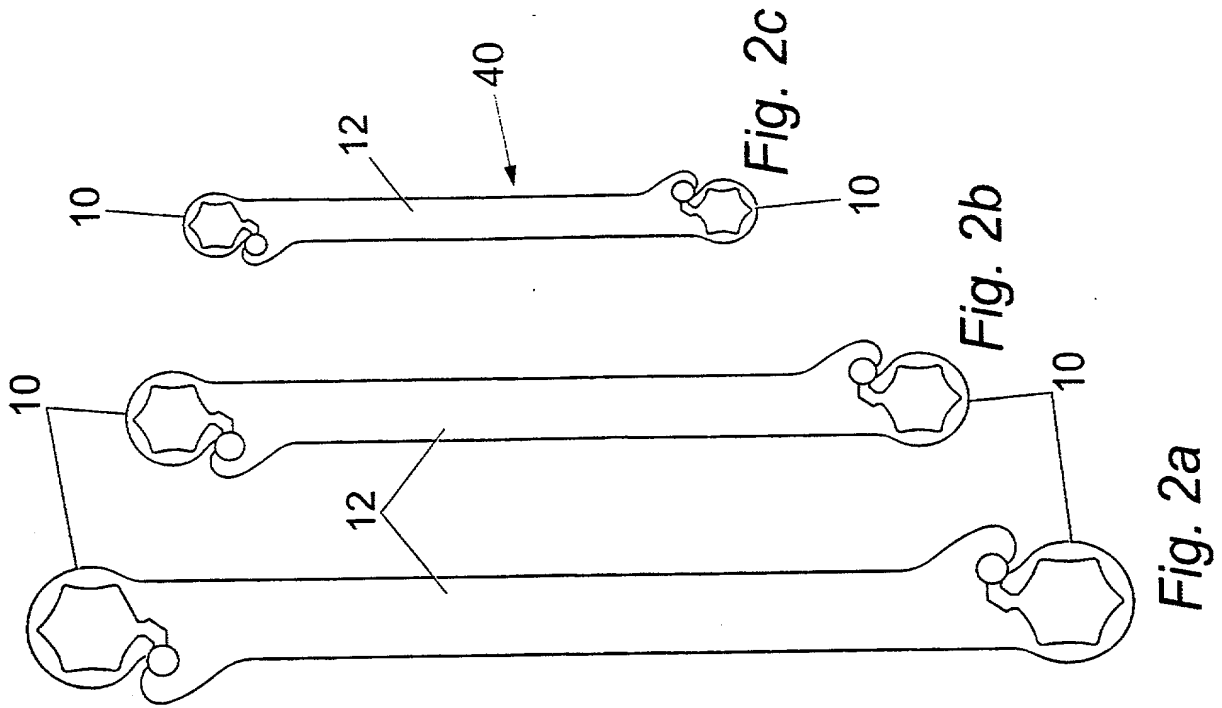
30
31 21. A wrench as claimed in claim 20, wherein first and
32 second segments (120a,b) of said ring (114) are formed

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1 integrally with one another as part of a pivot member
2 (200) pivotably mounted in said yoke (204) by means of
3 a pivot pin (206) and the remainder of said segments
4 (120c-f) are formed as discrete members, said flexible
5 elongate member being threaded through said remainder
6 of said segments (120c-f) and the free ends (202a,b)
7 thereof passing around an outer surface (214) of said
8 pivot member and around said pivot pin (206).

9
10 22. A wrench as claimed in Claim 21, wherein the first
11 free end (202a) of the flexible elongate member (202)
12 extends from one of said discrete segments (120f),
13 passes around one part of said outer surface (214) of
14 said pivot member (200) opposite an inner surface
15 thereof defining a first segment (120a), over the top
16 of, around and under the pivot pin (206), and out of
17 the front of the yoke portion (204), and wherein the
18 second free end (202b) of the of the elongate flexible
19 member (202) extends from another of said discrete
20 segments (120c), passes around a second part of said
21 outer surface (214) of the pivot member (200) opposite
22 an inner surface thereof defining a second segment
23 (120b), under the first free end (202a) and the pivot
24 pin (206), and out of the front of the yoke portion
25 (204).

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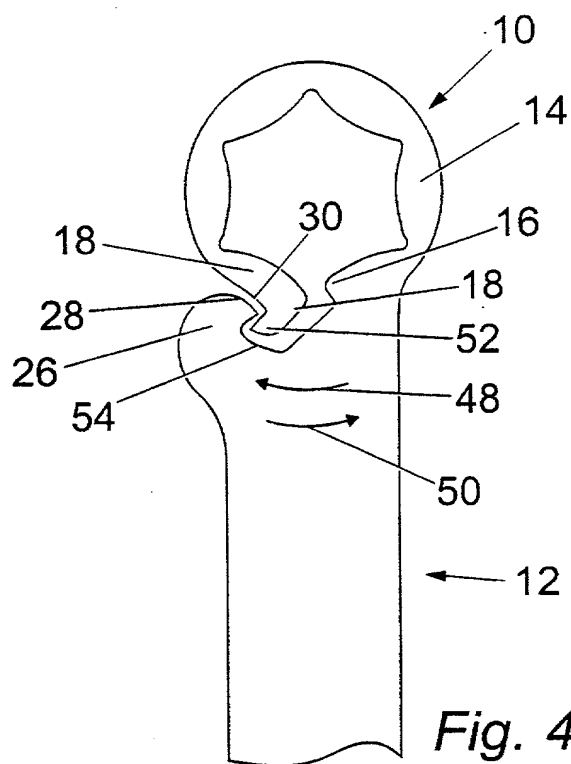


Fig. 4a

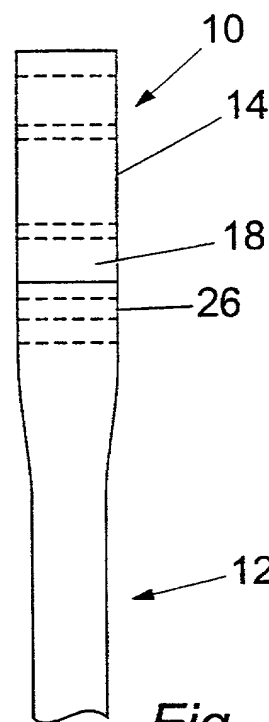


Fig. 4b

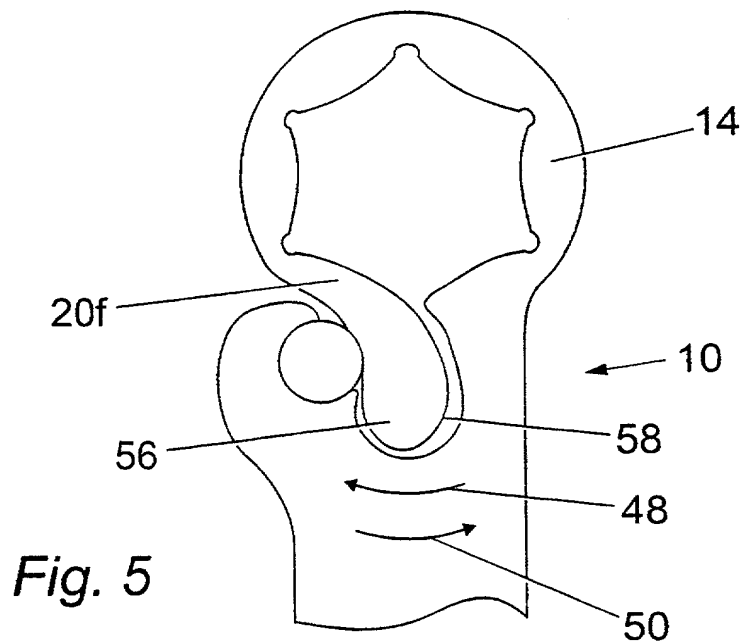


Fig. 5

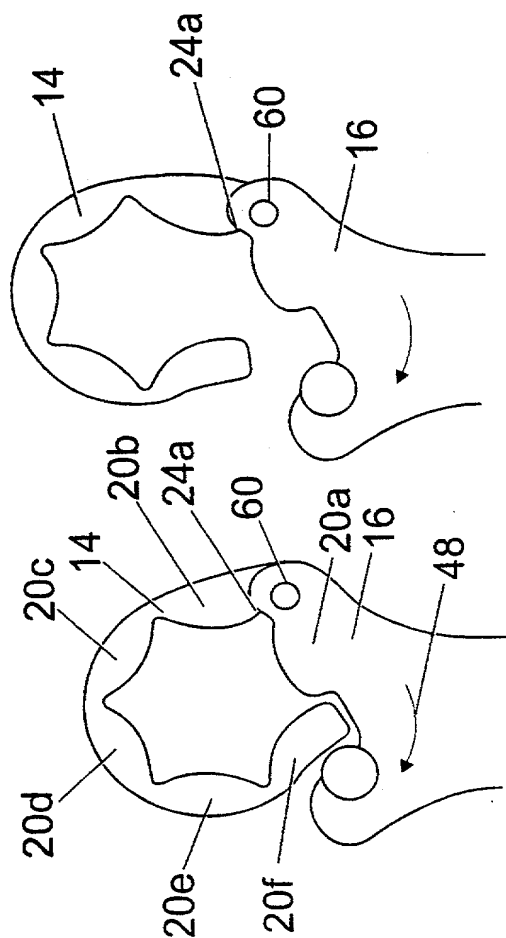


Fig. 6a

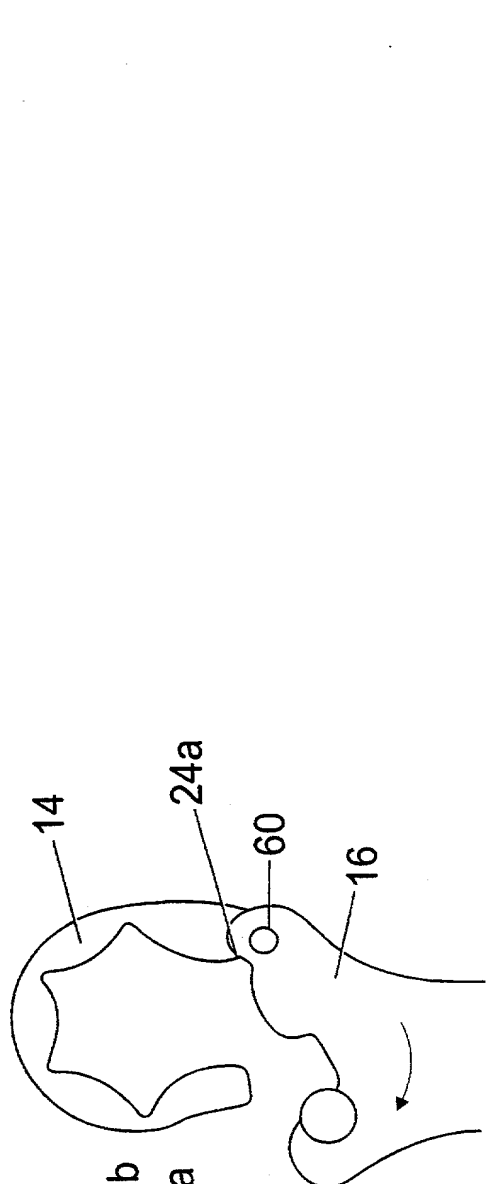


Fig. 6b

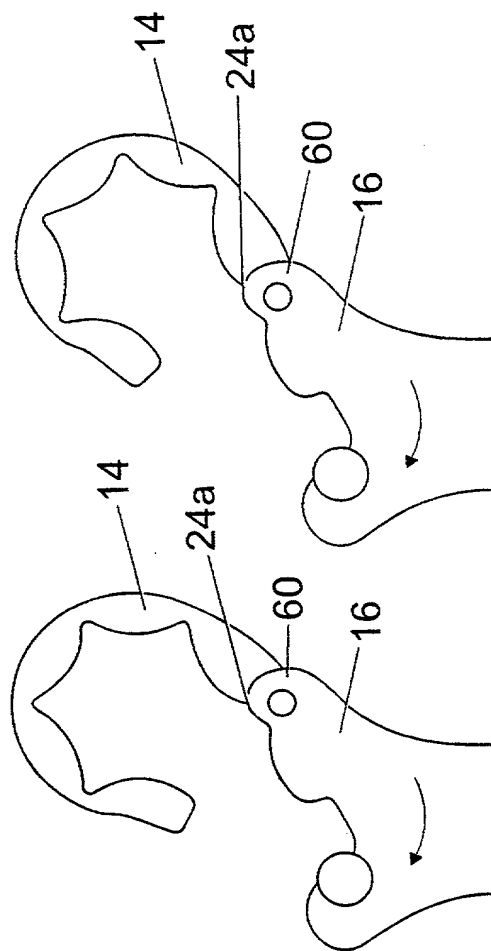


Fig. 6c

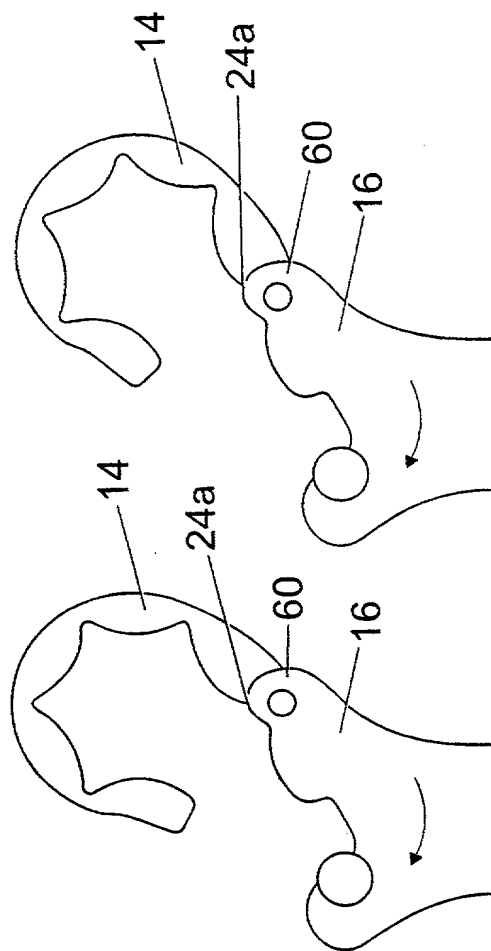


Fig. 6d

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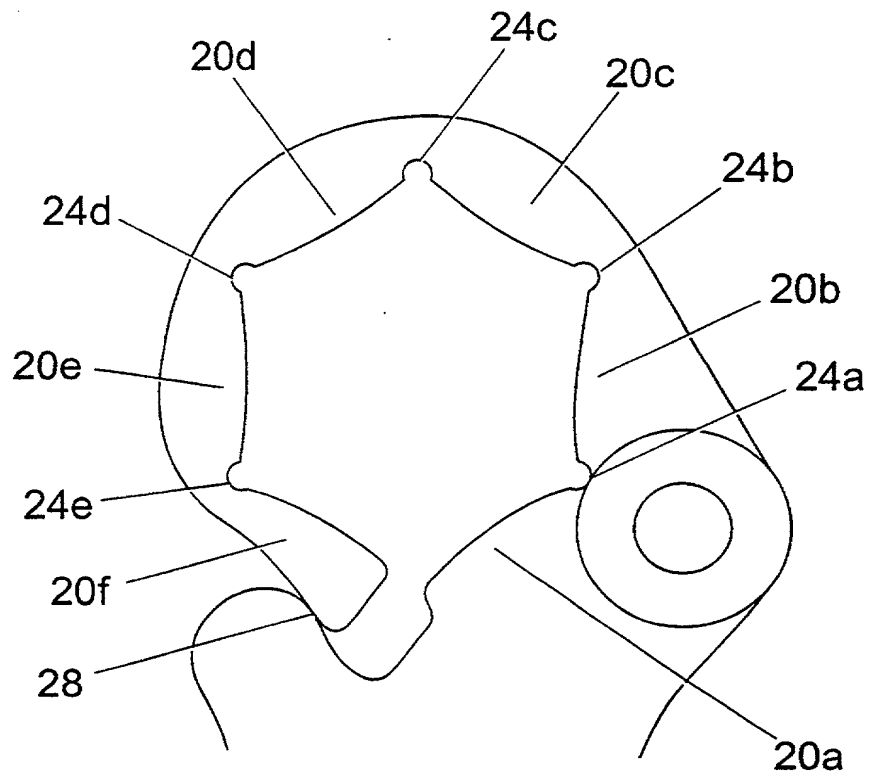


Fig. 7

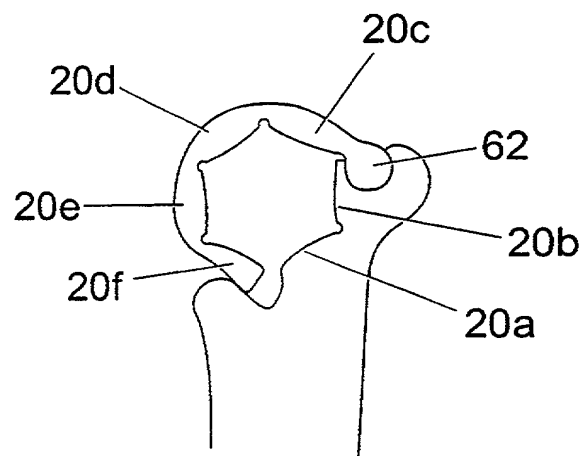


Fig. 8

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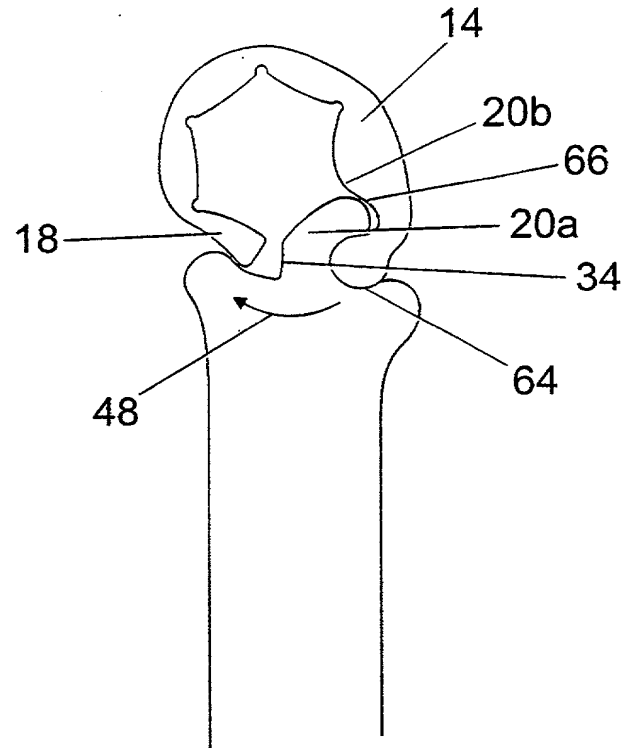


Fig. 9

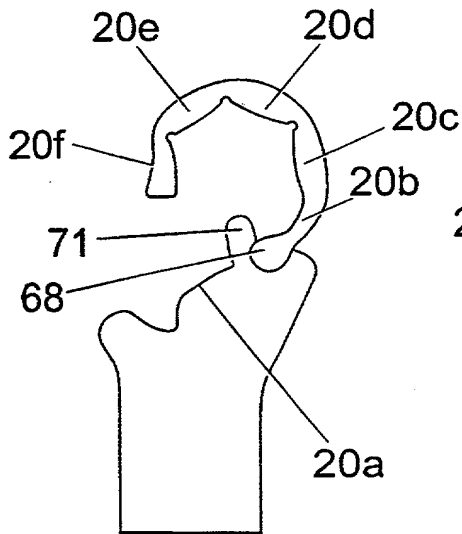


Fig. 10a

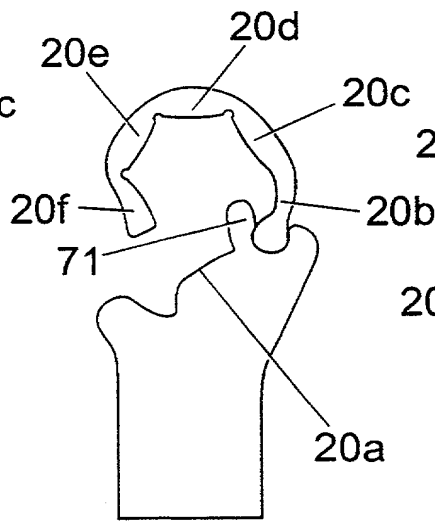


Fig. 10b

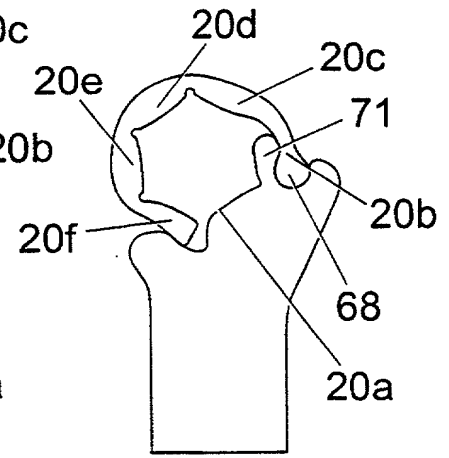


Fig. 10c

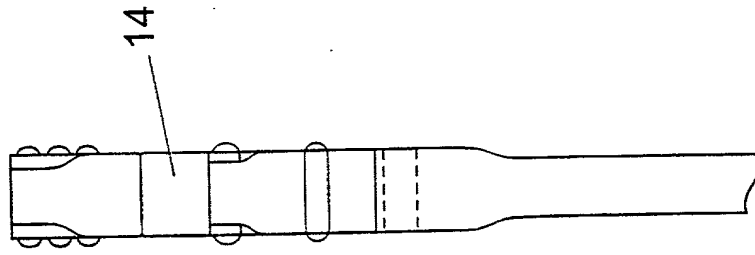


Fig. 11c

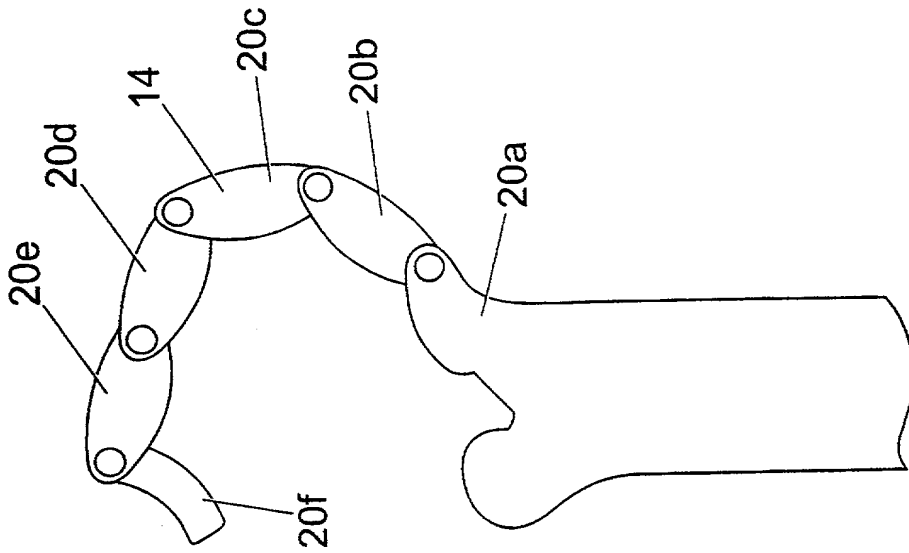


Fig. 11b

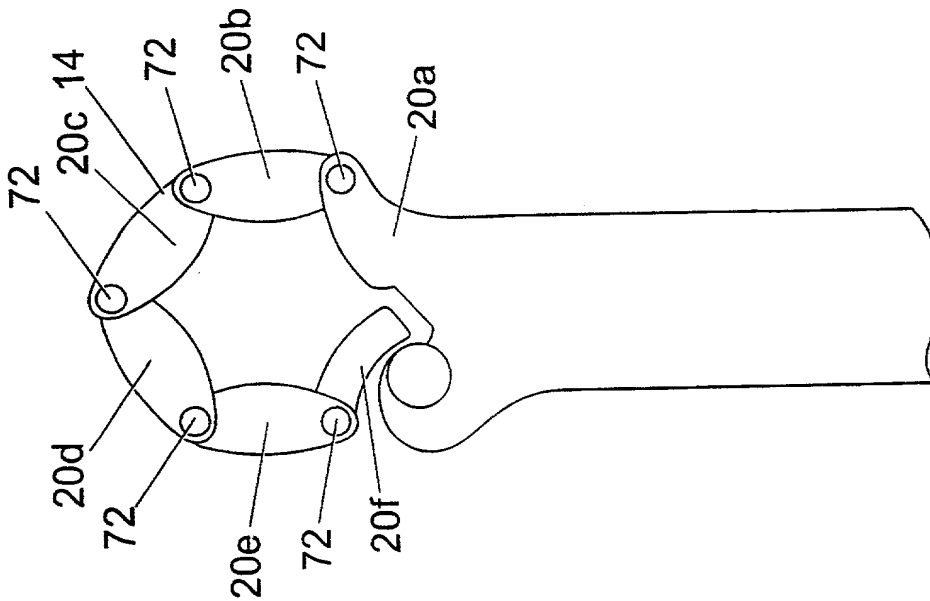


Fig. 11a

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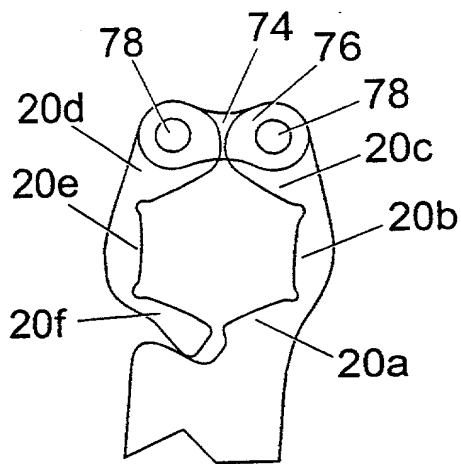


Fig. 12a

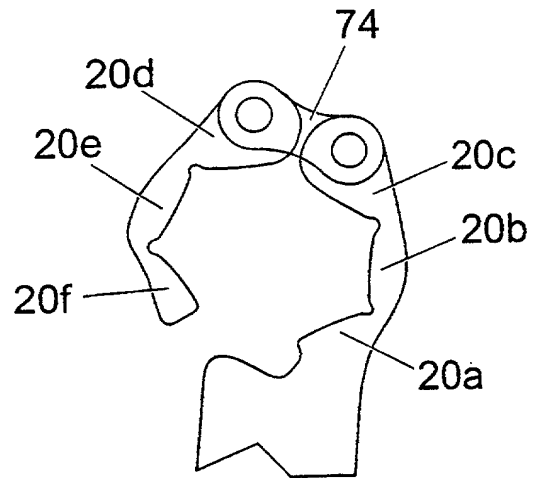


Fig. 12b

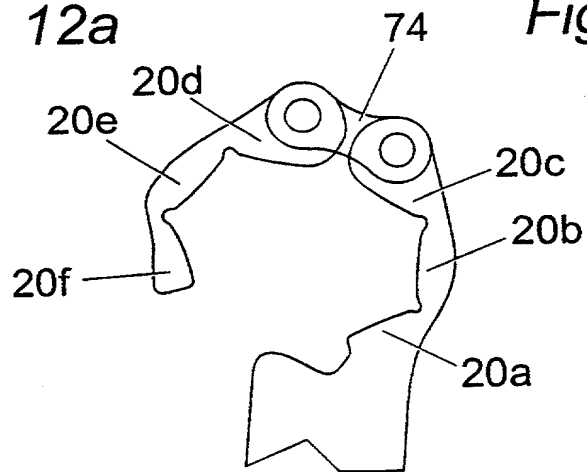


Fig. 12c

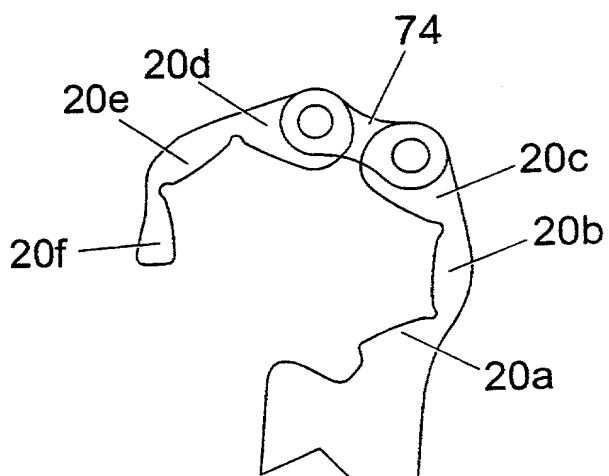


Fig. 12d

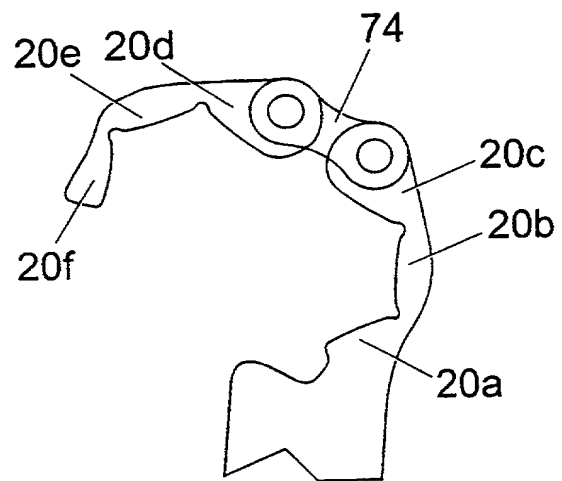
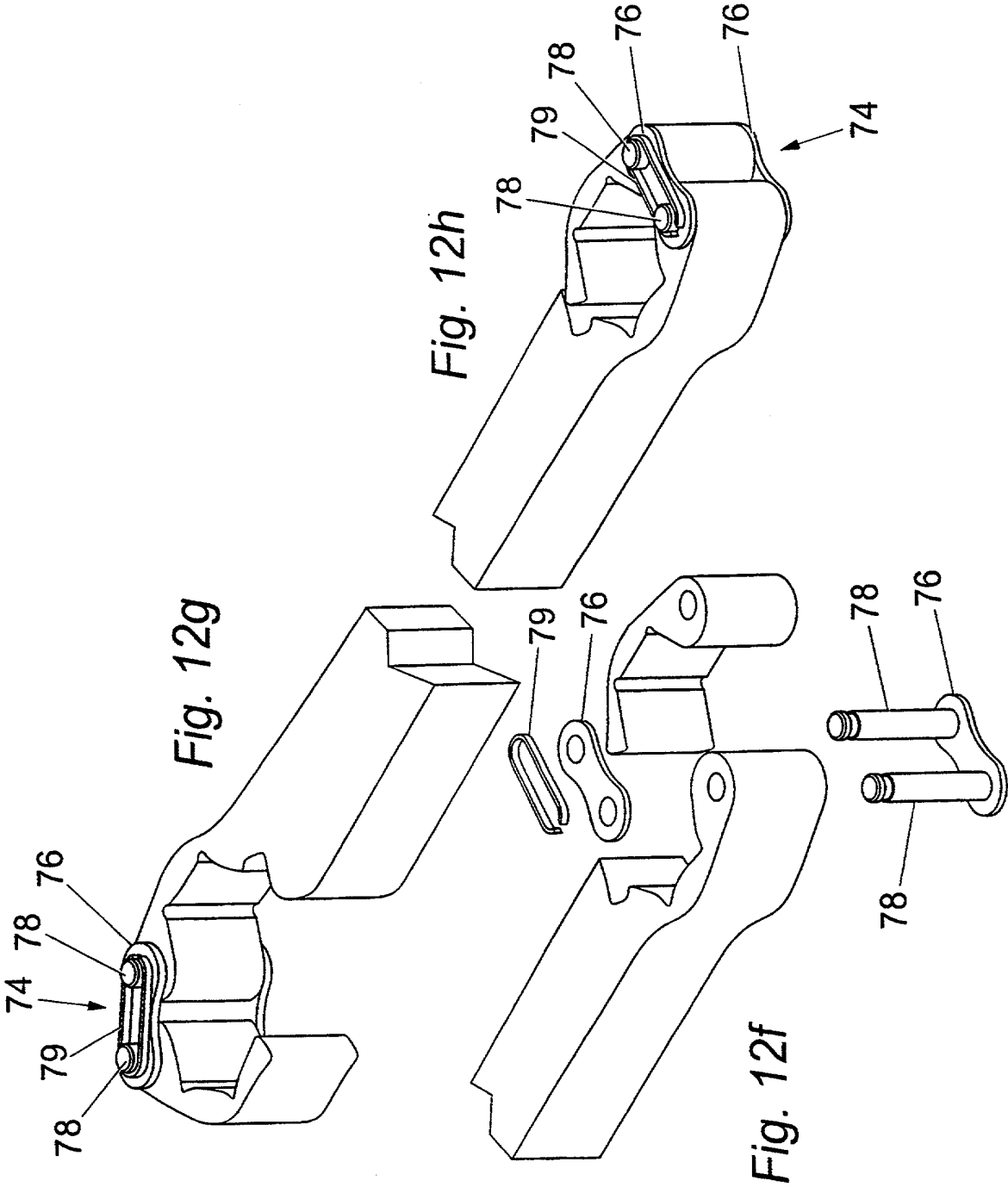


Fig. 12e



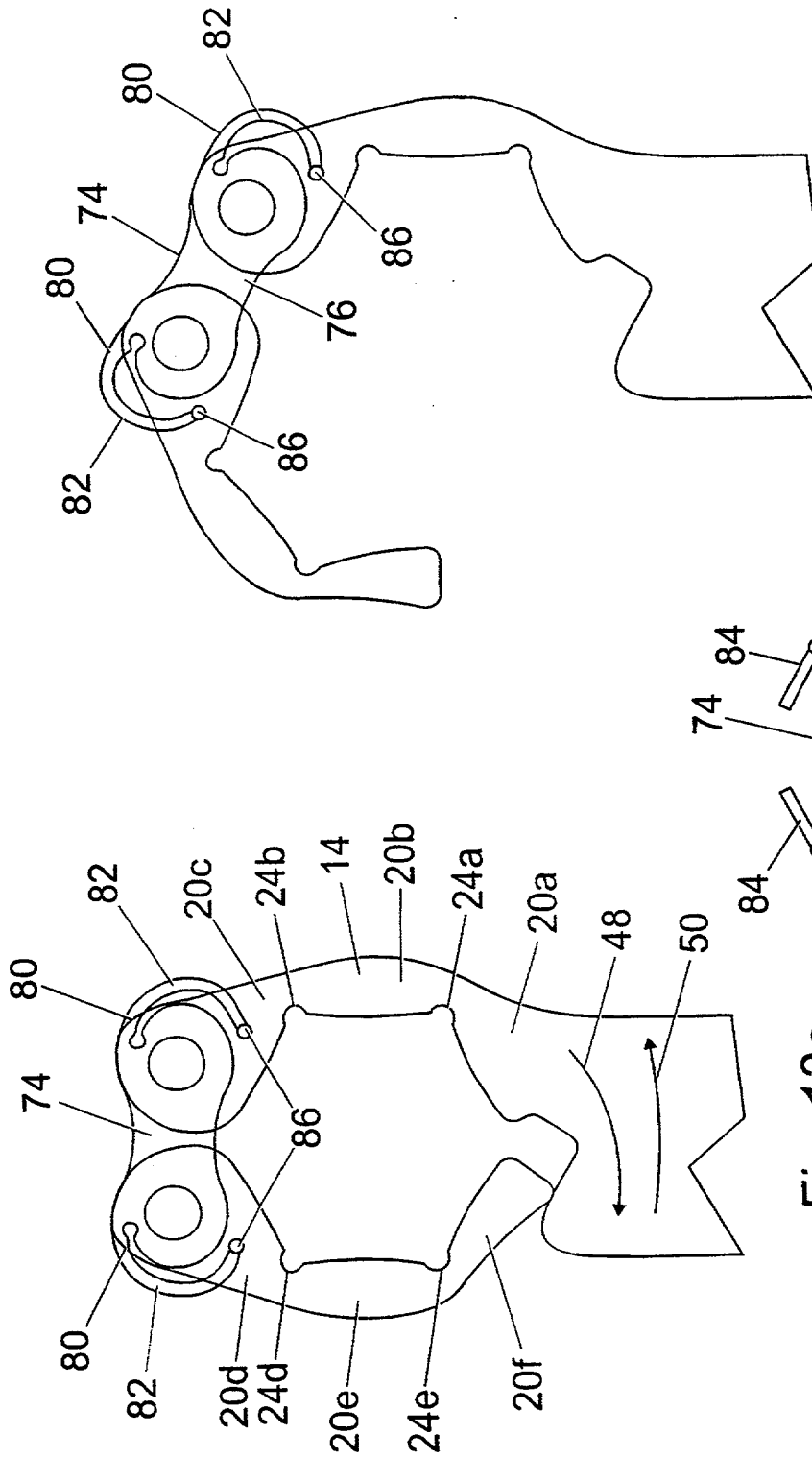


Fig. 13a

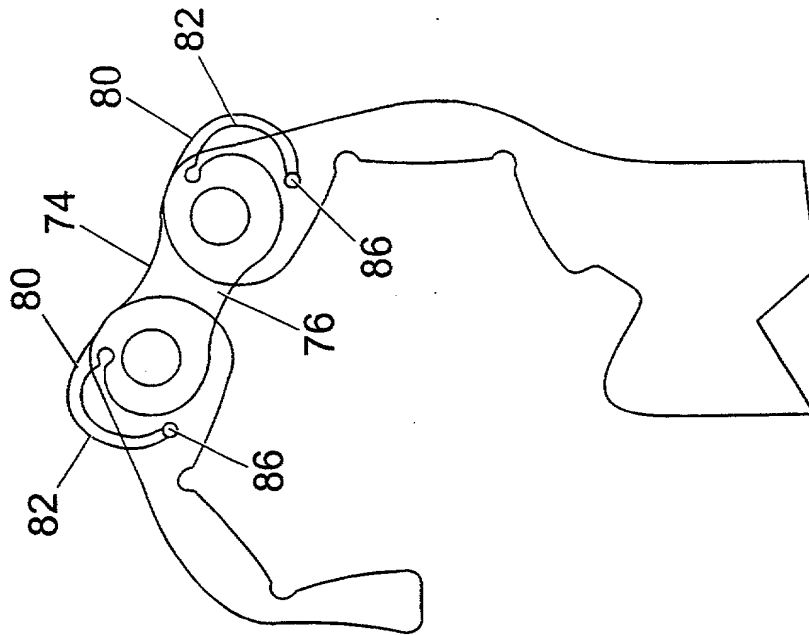


Fig. 13b

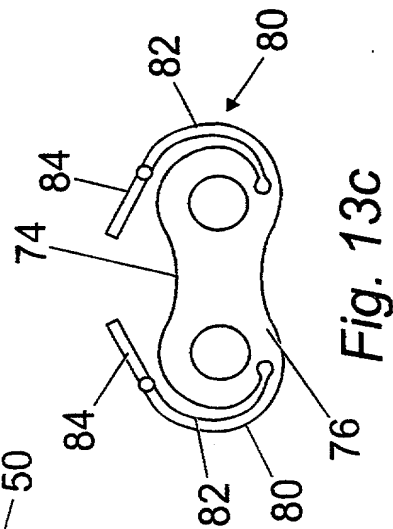


Fig. 13c

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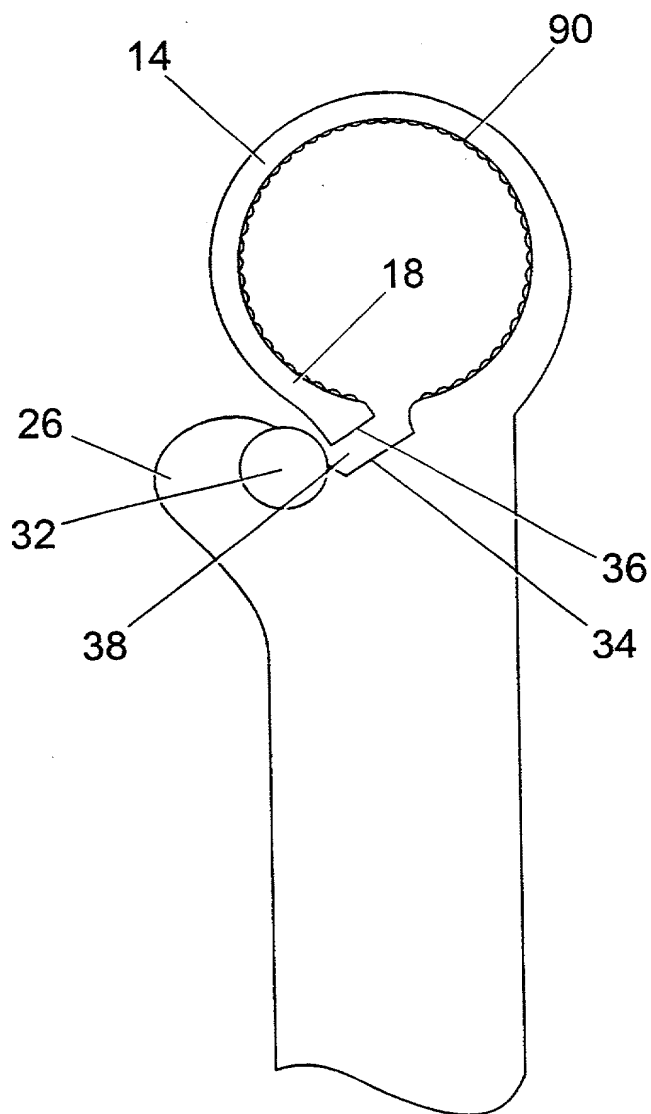


Fig. 14

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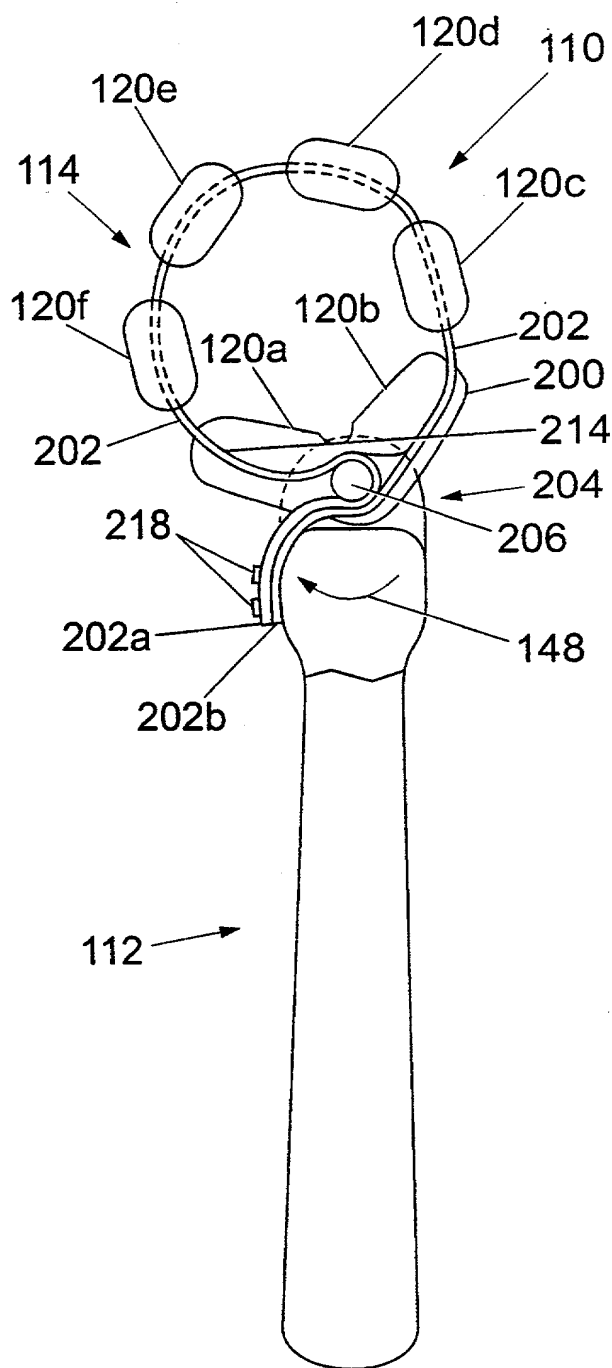


Fig. 15a

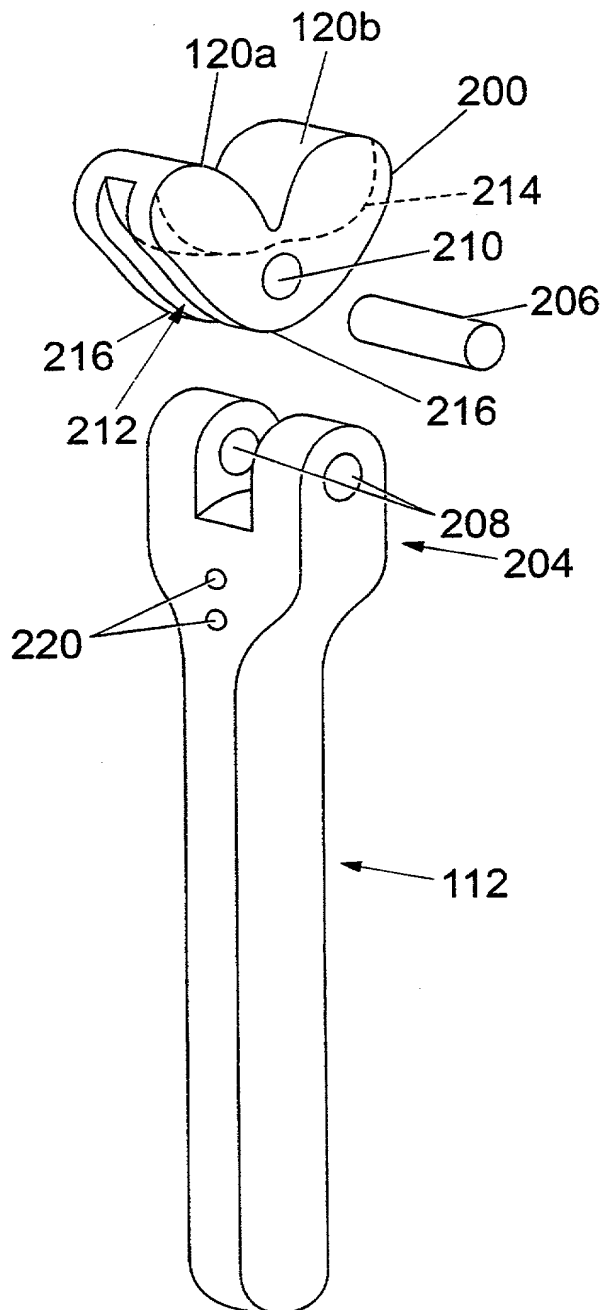


Fig. 15b

DECLARATION FOR PATENT APPLICATION

20234/0073

As a below-named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

WRENCH

the specification of which: (check one)

☐ is attached hereto. ☒ was filed on March 29, 2000, as PCT International Application Number PCT/GB00/01204, and was filed on October 1, 2001, as U.S. patent application Serial No. 09/937,767, and amended on October 1, 2001 (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the patentability of this application in accordance with 37 CFR § 1.56(a).

Prior Foreign Application(s): I hereby claim foreign priority benefits under 35 U.S.C. § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate listed below, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:

(Application No.)	(Country)	(Day/Month/Year Filed)	Priority Claimed
9907059.1	UK	29/March/1999	<input checked="" type="checkbox"/> YES
			<input type="checkbox"/> NO
			<input type="checkbox"/> YES
			<input type="checkbox"/> NO
			<input type="checkbox"/> YES
			<input type="checkbox"/> NO

I hereby claim the benefit under 35 U.S.C. § 120 of any United States application(s) listed below or 34 U.S.C. § 365(c) of any PCT International Application designating the United States of America listed below, and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application or PCT application in the manner provided by 35 U.S.C. § 112, first paragraph, I acknowledge the duty to disclose material information as defined in 37 CFR § 1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

(U.S. or PCT Application Serial No.)	(U.S. or PCT Filing Date)	(Status - patented, pending, abandoned)

I hereby appoint the following registered practitioners: Rudolf E. Hutz, Reg. No. 22,397; Harold Pezzner, Reg. No. 22,112; Richard M. Beck, Reg. No. 22,580; Paul E. Crawford, Reg. No. 24,397; Burton A. Amernick, Reg. No. 24,852; Stanley B. Green, Reg. No. 24,351; Morris Liss, Reg. No. 24,510; George R. Pettit, Reg. No. 27,369; Patricia J. Smink Rogowski, Reg. No. 33,791; Robert G. McMorro, Jr., Reg. No. 30,962; Ashley I. Pezzner, Reg. No. 35,646; William E. McShane, Reg. No. 32,707; Mary W. Bourke, Reg. No. 30,982; Gerard M. O'Rourke, Reg. No. 39,794; James M. Olsen, Reg. No. 40,408; Francis DiGiovanni, Reg. No. 37,310; Eric J. Evain, Reg. No. 42,517; Daniel C. Mulveny, Reg. No. 45,897; Patrick J. Wells Reg. No. 46,355; Thomas F. Poche Reg. No. 45,017; Patrick H. Higgins, Reg. No. 38,709; Christine M. Hansen, Reg. No. 40,634; Daniel Harbison, Reg. No. 47,631; Gary Bridge, Reg. No. 44,560; Larry J. Hume, Reg. No. 44,163; Joseph Barrera 44,522; John A. Evans, (Agent) 44,100; and Elliot C. Mendelson (Agent), Reg. No. 42,878, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full name of sole or first inventor Nigel Buchanan

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